TECHNICAL FIELD

[0023] This application relates generally to fluid delivery systems, and more particularly to apparatus, systems and methods for infusion pump assemblies.

BACKGROUND INFORMATION

[0024] Many potentially valuable medicines or compounds, including biologicals, are not orally active due to poor absorption, hepatic metabolism or other pharmacokinetic factors. Additionally, some therapeutic compounds, although they can be orally absorbed, are sometimes required to be administered so often it is difficult for a patient to maintain the desired schedule. In these cases, parenteral delivery is often employed or could be employed.

[0025] Effective parenteral routes of drug delivery, as well as other fluids and compounds, such as subcutaneous injection, intramuscular injection, and intravenous (IV) administration include puncture of the skin with a needle or stylet. Insulin is an example of a therapeutic fluid that is self-injected by millions of diabetic patients. Users of parenterally delivered drugs may benefit from a wearable device that would automatically deliver needed drugs/compounds over a period of time.

[0026] To this end, there have been efforts to design portable and wearable devices for the controlled release of therapeutics. Such devices are known to have a reservoir such as a cartridge, syringe, or bag, and to be electronically controlled. These devices suffer from a number of drawbacks including the malfunction rate. Reducing the size, weight and cost of these devices is also an ongoing challenge. Additionally, these devices often apply to the skin and pose the challenge of frequent re-location for application.

SUMMARY OF THE INVENTION

[0027] In accordance with one aspect of the present invention, a system for delivery of a volume of infusible fluid is disclosed. The system includes a controller configured to calculate a trajectory for delivering infusible fluid, the trajectory comprising at least one volume of fluid, and determine a schedule for delivering the at least one volume of fluid according to the trajectory, wherein the schedule comprising an interval and a volume of infusible fluid for delivery. The system also includes a volume sensor assembly for determining the at least one volume of fluid delivered, wherein the controller recalculates the trajectory based on the volume of fluid delivered.

[0028] Some embodiments of this aspect of the invention include one or more of the following. Wherein the trajectory is based on delivery commands received by the controller, wherein the delivery commands include bolus and basal commands, and/or wherein the system includes a pump. In some embodiments where the system includes a pump, the system may additionally include one or more of the following: wherein the schedule is determined based on a maximum pulse volume of the pump, wherein the schedule is determined based on the minimal pulse volume of the pump, wherein the schedule is determined based on the power consumption of the pump, wherein the schedule is determine based on a minimal pulse interval of the pump. In some embodiments, the system may include wherein the schedule comprising equal volumes of infusible fluid.

[0029] In accordance with one aspect of the present invention, a medical infusion device for delivering an infusible medical fluid is disclosed. The device includes a pump having a minimum and maximum pulse volume, a controller configured to determine a first volume of infusible medical fluid delivered, and based on the first volume of infusible medical fluid delivered, determine a time and volume for delivery of a second volume of infusible fluid.

[0030] Some embodiments of this aspect of the invention include one or more of the following: wherein the infusion device further comprising a disposable housing assembly and reusable housing assembly, wherein the reusable housing assembly further includes a locking ring assembly, wherein the reusable housing assembly releasably engages the disposable housing assembly by way of the locking ring assembly, wherein the locking ring assembly includes a spring, a tab that connects to the spring, and a magnet that connects to the tab. Wherein the disposable housing assembly further includes a reservoir wherein the pump effectuates the movement of infusible medical fluid from the reservoir to a volume sensor assembly, wherein the pump is driven by a shape memory alloy, wherein the infusion pump of claim further comprising a split ring resonator antenna, wherein the device further includes a volume sensor assembly for determining the first volume and the second volume of infusible medical fluid delivered and/or wherein the volume sensor assembly includes an acoustically contiguous region having a volume that varies based upon the quantity of infusible fluid received from the reservoir, and an acoustic energy emitter configured to provide acoustic energy at a plurality of frequencies to excite a gas included within the acoustically contiguous region.

[0031] In accordance with one aspect of the present invention a controller for a medical infusion device for delivering a medical fluid is disclosed. The controller includes a volume sensor assembly for determining a first volume of infusible fluid delivered, a processor for determining the difference between a desired first volume of infusible fluid to be delivered and the actual first volume of infusible fluid delivered, and a processor for determining a schedule and volume for delivering a second volume of infusible fluid based on the difference.

[0032] Some embodiments of this aspect of the invention include one or more of the following: wherein the volume sensor assembly includes an acoustically contiguous region having a volume that varies based upon the quantity of infusible fluid received from the reservoir, and an acoustic energy emitter configured to provide acoustic energy at a plurality of frequencies to excite a gas included within the acoustically contiguous region.

[0033] According to a another implementation, a wearable infusion pump assembly includes a reservoir for receiving an infusible fluid, and a fluid delivery system configured to deliver the infusible fluid from the reservoir to an external infusion set. The fluid delivery system includes a volume sensor assembly configured to receive a quantity of the infusible fluid from the reservoir. The volume sensor assembly includes an acoustically contiguous region having a volume that varies based upon the quantity of infusible fluid received from the reservoir. The volume sensor assembly further includes an acoustic energy emitter configured to provide acoustic energy at a plurality of frequencies to excite a gas included within the acoustically contiguous region.

[0034] One or more of the following features may be includes. The volume sensor assembly may further include a first acoustic energy receptor for receiving at least a